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Hotto

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[54] DC INTEGRATING DISPLAY DRIVER EMPLOYING PIXEL STATUS MEMORIES

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Related U.S. Application Data

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[52] **U.S. Cl.** **345/94;** 345/148

[58] **Field of Search** 345/89, 94, 96, 101, 345/100, 148

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,737,782	4/1988	Fukuma et al. .	
5,010,326	4/1991	Yamazaki et al.	345/98
5,034,736	7/1991	Bennett et al.	345/100
5,280,280	1/1994	Hotto	345/148

OTHER PUBLICATIONS

"Selection Limits in Matrix Displays," Alan Sobel; Revised 1971, pp. 1-34 & Figures 1-6.

"Scanning Limitations of Liquid-Crystal Displays," Alt & Pleshko; Feb. 1974, pp. 146-155.

"Liquid Crystal Displays," L. A. Goodman; Sep./Oct. 1973, Cover sheet & pp. 816-823.

"Switching Properties of Twisted Nematic Liquid Crystal Displays," Cess J. Gerritsma; May 1974, pp. 164-165.

"Experimental Comparison of Multiplexing Techniques for Liquid Crystal Displays," A. R. Kmetz; 1972, pp. 66-67.

"Ultimate Limits for Matrix Addressing of RMS-Responding Liquid-Crystal Displays," Nehring & Kmetz; May 1970, pp. 795-802.

"Liquid Crystal Displays," Allan R. Kmetz; 12/81, pp. 3-8.

"Combined Alphanumeric and Dot Matrix Display As Base For A New Measuring Concept," Dr. Martin W. Haussel; pp. 1-5.

"6.1: A Twisted Nematic Dual Bargraph System," Allan R. Kmetz; 1977, pp. 58-59.

"Characterization and Optimization of Twisted Nematic Displays for Multiplexing," Alan R. Kmetz; 1978, pp. 70-71.

"Interconnection and Addressing Methods for LCD Arrays with Fewer Leads Than a Matrix," A. R. Kmetz; Jul. 1983, pp. 131-134.

"Matrix Addressing of Non-Emissive Displays," A. R. Kmetz; (Undated), pp. 261-289.

"Liquid-Crystal Display Prospects in Perspective," Allan R. Kmetz; Nov. 1973, pp. 954-961.

"Ultimate Limits For RMS Matrix Addressing," A. R. Kmetz & J. Nehring; (Undated), pp. 105-113.

"Addressing Methods for Non-Multiplexed Liquid Crystal Oscilloscope Displays," Ian A. Shanks & Paul A. Holland; 1979, pp. 112-113.

(List continued on next page.)

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[57] **ABSTRACT**

This invention relates to an improved drive and control means for matrix addressable electro-optic displays, such as passive matrix LCDs and active matrix LCDs. The present invention achieves improved drive and control of displays through the use of real time computation and memory circuits to simulate the electro-optic condition and the accumulated DC bias of individual display elements. This eliminates the burden of frequent and symmetrical reversals of the drive polarity, and allows the implementation of flexible DC drive methodologies.

65 Claims, 8 Drawing Sheets